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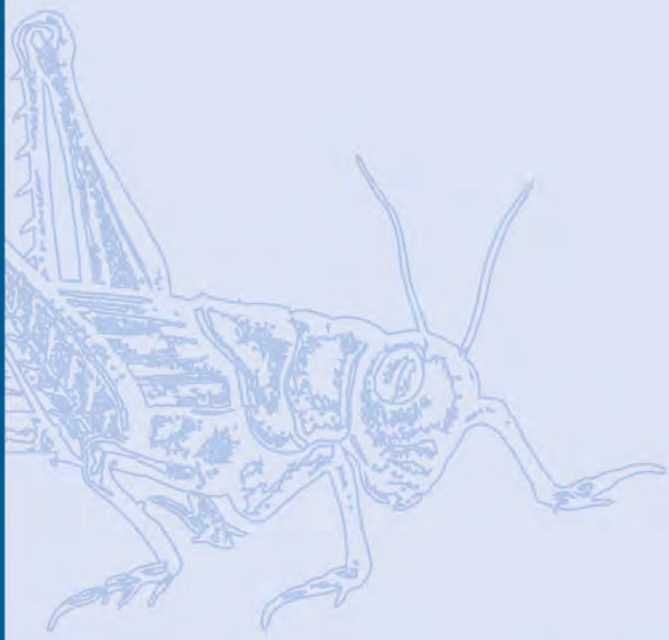

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Forecasting locust risks

STUDIES TO IMPROVE THE FORECASTING OF THE SOUTH AMERICAN LOCUST, SCHISTOCERCA CANCELLATA IN ARGENTINA

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The south american locust (sal), *schistocerca cancellata*, was in plague proportions in 48 of the 58 years from 1897 to 1954, but following the introduction of a program of preventive management, there were no plagues for 60 years. Preventive management relies on regular monitoring of locust infestations in northwest Argentina (nwa) with treatment of any bands and swarms detected. However, many swarms "suddenly" appeared in Santiago del Estero province in nwa in July 2015, and populations then increased further to reach plague proportions. We aimed to analyse the factors leading to the initial outbreak of swarms and their further increase through two complementary approaches: 1) a chronological analysis relating population dynamics to rainfall and 2) a correlation analysis looking at reproduction events and vegetation dynamics. Both were conducted using a sal monitoring data base running from 2013 to 2018.

Previous studies during the 1980's found a correlation between outbreaks and rains from winter/early spring through summer in nwa allowing three generations in a season. It was hypothesized that rainfall provided green herbaceous vegetation for adult maturation and survival of nymphs, and soil moisture for egg survival and hatching. Our analyses show that during the 2014-15 seasons, only two generations were possible in catamarca, and the few bands found there were treated. However, even though three generations were possible in at least four other provinces in nwa, except for la rioja, they had either limited surveys or none at all. These provinces could have been the source of breeding that led to the July 2015 swarms. Three generations were also possible in many areas during both 2015-16 and 2016-17 seasons-resulting in further sal population increase. During the summer of 2016-17, most locusts migrated to Bolivia and Paraguay and had the third generation there. During June 2017, these swarms invaded Argentina in plague proportions and even though a number of swarms were treated, widespread oviposition was reported. While the large 2017 outbreak of the sal was eventually reduced, early infestations were not detected which may be avoided in the future by having a system in place to detect conditions particularly favourable for locusts. Modis satellite imagery was used to analyse vegetation conditions in the permanent breeding and recession regions of nwa. based on a logistic regression approach, the presence/absence of reproduction events was correlated to point ndvi measures with and without a range of time lags with respect to monitoring dates, the minimum and maximum historical ndvi, and the ndvi difference between date of reproduction events and minimum historical ndvi. The most promising models were identified with aic and auc statistics. These models reported a potential increase of reproduction success in areas with high historical ndvi variation, which is a signature of semi-desert areas, and recent increase in ndvi at a scale of 2 months, which supports the hypothesis of outbreaks being related to rainfall. These results could be the basis of an improved early warning system for sal preventive management.

Key Words: South American locust, upsurge, forecast, ndvi, rainfall.